

# **MSTV Presentation/Discussion with OET**

Victor Tawil and Bruce Franca  
December 18, 2007

---



# White Space Device Testing

- FCC Test Plan and Schedule
  - Test Objectives?
- MSTV October 15 letter to OET
  - Specific Questions Raised
- Status of MSTV Recommendations and Suggestions

# White Space Device Testing

- Laboratory tests should measure performance that is representative of actual use. For example, following are some of the suggestions made:
  - Performance of antenna system used for sensing must be included in laboratory tests
  - Impact of close-in obstructions such as the body must be taken into account to determine actual results in laboratory tests
  - Effect of multiple DTV signals, including 3<sup>rd</sup> order IM that will occur in practice, should be laboratory tested to determine impact

# White Space Device Testing

- Laboratory tests should measure performance that is representative of actual use. For example, following are some of the suggestions made (cont'd):
  - Sensing acquisition time must be tested and limited to realistic operational values
  - Impact of transmitter on sensing receiver
  - Typical co-channel and adjacent channel interference ranges need to be determined

# White Space Device Testing

- Field testing should include enough different locations to be representative of both TV reception and unlicensed operation throughout the United States. For example:
  - Urban, suburban and rural areas should be represented
  - Variations in terrain, vegetation and other features that affect propagation
  - Seasonal variation should also be taken into account
  - Testing should include areas with significant number of TV stations in operation including adjacent channel, second adjacent channel, channels with IM relationships and areas with relatively few stations in operation

# Recent Filings

- Motorola
  - Failed to address adjacent channel interference
- Google
  - Submitted data shows -120 dBm sensing level inadequate
  - Raises antenna performance issue

# Recent Filings

- Motorola
  - Co-channel interference and analysis
  - Addressed cable interference
  - Suggests 10 mW output power solution
  - Failed to provide adjacent channel “over-the-air” analysis for fixed or mobile
- Reducing power to 10 mW does NOT eliminate adjacent channel interference
- Using FCC curves to determine adjacent channel operation will not eliminate interference

# Adjacent Channel Protection

- FCC Receiver Tests measured “best case” adjacent channel receiver performance
  - Sample included only “best” TVs
  - Extreme filtering to ensure only out of channel effects measured
    - Real world “in band” splatter ignored
  - Adjacent channel D/U ratio of -40 dB
- ATSC A/74 Recommendations
  - Adjacent channel D/U of -33 dB (moderate and weak)
- CRC, U of K
  - Adjacent channel D/U less than -33 dB measured
- Existing FCC Rules for LPTV
  - Lower Adjacent channel D/U for strong signal case

# Adjacent Channel Protection

“Best Case” for WSD Manufacturers (D/U of -40 db)

## 100 mW Case

- 100mw = 20 dBm
- 10 m Free Space Path Loss = 48 dB
- 100 mW transmitter at 10 meters is -28 dBm
- Interference caused to viewers with TV signal less than -68 dBm

## 10 mW Case

- 10 mW = 10 dBm
- 10 m Free Space Path Loss = 48 dB
- 10 mW transmitter at 10 meters is -38 dBm
- Interference cause to viewers with TV signal less than -78 dBm

# Adjacent Channel Protection

- Bottomline: Even under “best case” scenario interference will be caused to TV viewers
- Part 15 standards can not be based on situation where interference is guaranteed to occur to the public
- Mobile DTV service calls into question both 10m distance and measured D/Us

## Recent Google Filing



- Provided indoor and outdoor test data
- States that device has average sensitivity of -120 dBm level
- Data indicates that device will not accurately detect viewable DTV signals
- Raises practical antenna performance issues

# Antenna Performance and Sensing Level



- How do you take the antenna performance into account for sensing level
- Moore's law holds for electronics not antenna performance
- Not a particularly practical personal portable antenna design

# Antenna Performance and Sensing Level



Signal Level Here Doesn't Matter

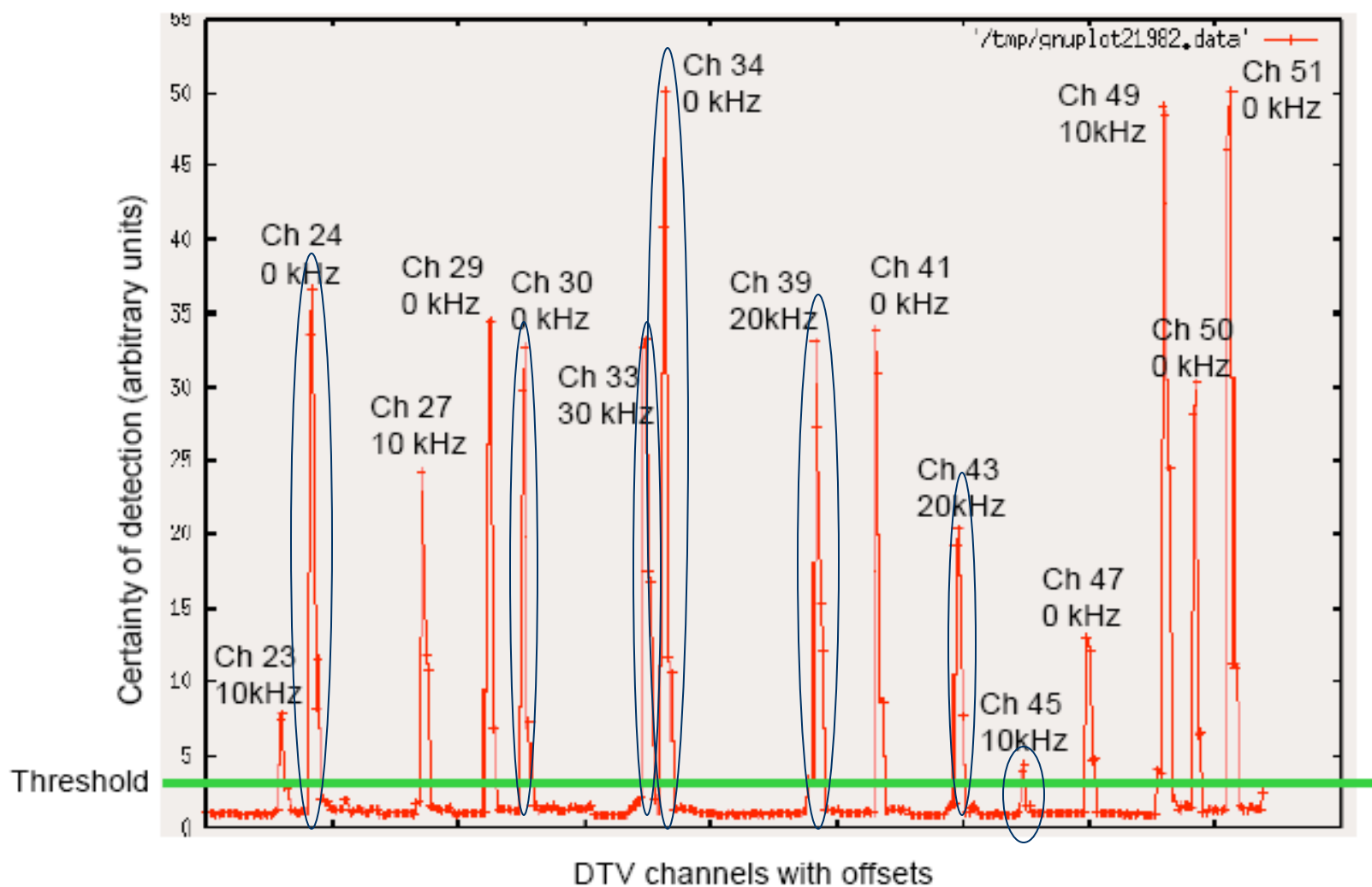
Signal Level Here Matters

- Actual antenna gain and performance affects required sensing level
- 0 dBi not practical or realistic

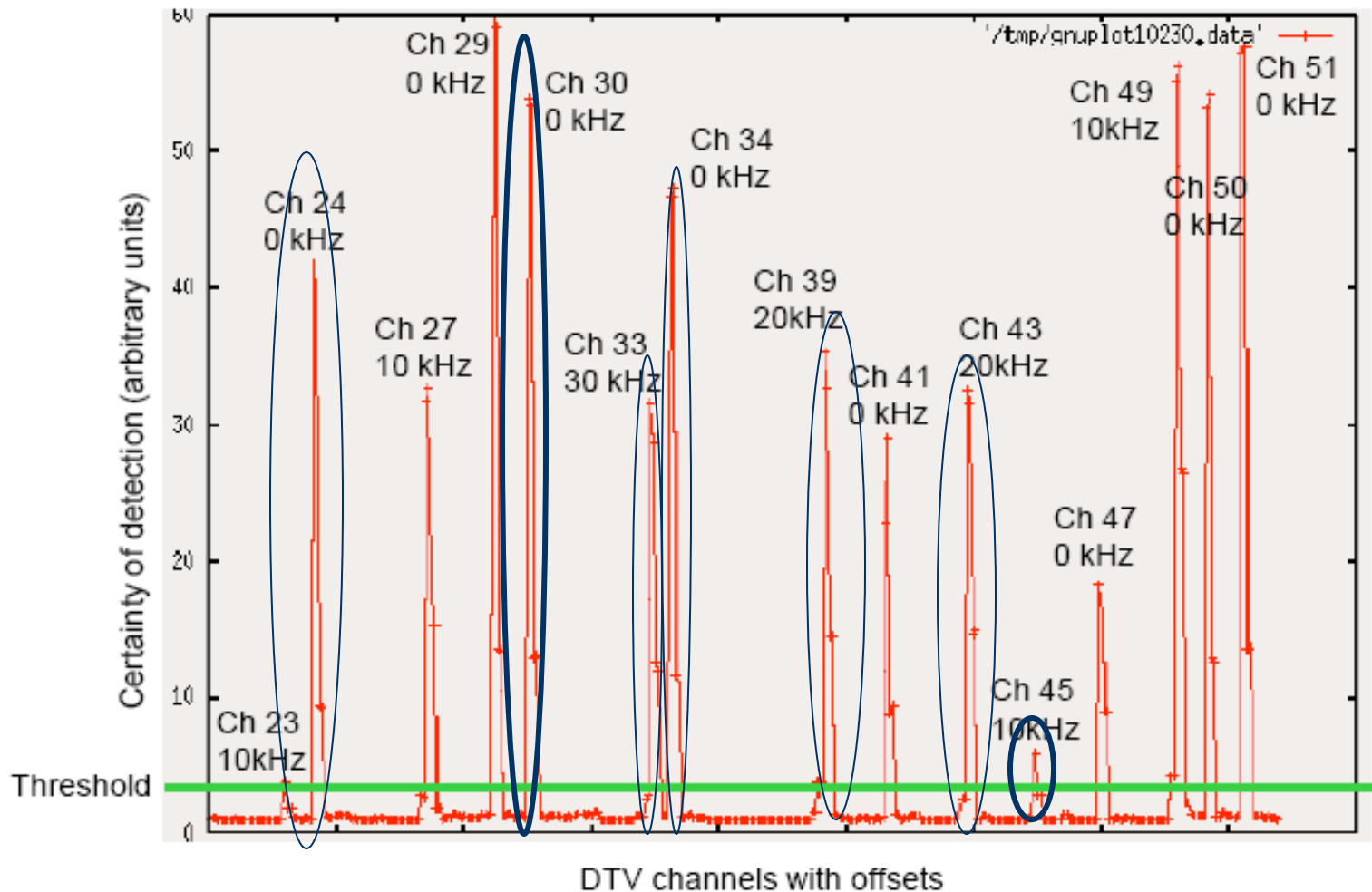
# Antenna Performance and Sensing Level

- FCC proposed rule referenced to 0 dBi antenna but best practical mobile antenna designs are about -7 to -10 dBi over more limited spectrum range
  - Cellular radio designs
  - Mobile TV applications
    - Qualcomm MediaFlo/DVB-H and T-DMB
- EBU – TECH 3317 *Planning parameters for hand held reception*
  - “The antenna in a small hand-held terminal has to be an integral part of the terminal construction and will therefore be small when compared to the relevant wavelength. ... The restive part of the antenna impedance (radiation resistance), which is to be matched to the receiver input impedance, will be rather small ... This leads to rather high losses and to low overall efficiency. ...”
  - “Current understanding of the overall design problem indicates that a typical antenna gain at lowest UHF-band frequencies would be in the order of -10 dBi ...”
  - EBU document also notes that the relative position of the user and body absorption/reflection loss can cause additional signal loss

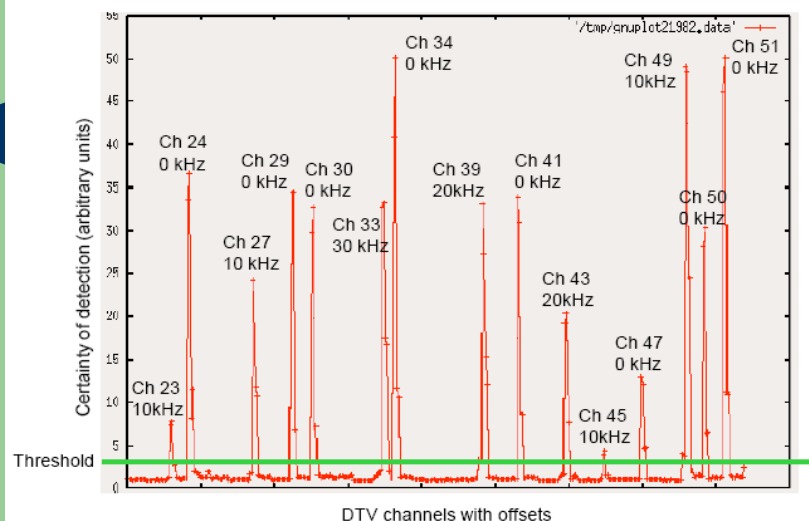
# Google Outdoor Results



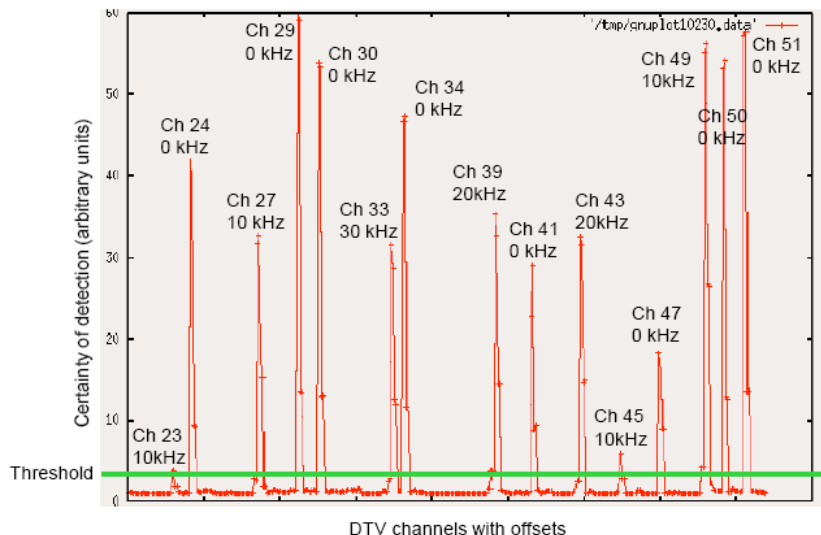
# Google Indoor Results (Circled results at same location)



# Google Results



Indoor Measurements



Outdoor Measurements

- Significant differences in outdoor and indoor measurements suggest that even -120 dBm sensing level unreliable
  - Channel 29 - +25 units
  - Channel 34 - -10 units
  - Channel 50 - +20 units
- Threshold level for channel 45 at only 30 miles provides strong indication of sensing failure

# TV Stations

All licensed (or CP) DTV stations within 200 km of N 37° 25' 12.26", W 122° 4' 59.40" (Mountain View, CA):

| Call    | Ch | Status      | City          | ERP      | HAAT  | Latitude      | Longitude      | Distance  | Det |
|---------|----|-------------|---------------|----------|-------|---------------|----------------|-----------|-----|
| KMAX-TV | 21 | ND   LIC    | SACRAMENTO    | 850. kW  | 581.2 | N 38 15 54.00 | W 121 29 24.00 | 107.33 km |     |
| KRCB    | 23 | DA   CP MOD | COTATI        | 105. kW  | 630.4 | N 38 20 54.70 | W 122 34 37.50 | 111.84 km | *   |
| KGO-TV  | 24 | DA   LIC    | SAN FRANCISCO | 561. kW  | 437.0 | N 37 45 19.00 | W 122 27 16.00 | 49.43 km  | *   |
| KOVR    | 25 | ND   LIC    | STOCKTON      | 760. kW  | 591.0 | N 38 14 24.00 | W 121 30 13.00 | 104.45 km |     |
| KTSP    | 27 | DA   LIC    | SAN FRANCISCO | 500. kW  | 403.4 | N 37 41 12.00 | W 122 26 13.00 | 42.87 km  | *   |
| KPIX-TV | 29 | DA   LIC    | SAN FRANCISCO | 1000. kW | 401.0 | N 37 45 20.00 | W 122 27 15.00 | 49.44 km  | *   |
| KQED    | 30 | DA   LIC    | SAN FRANCISCO | 777. kW  | 437.0 | N 37 45 19.00 | W 122 27 16.00 | 49.43 km  | *   |
| KSMS-TV | 31 | DA   CP     | MONTEREY      | 50. kW   | 700.6 | N 36 45 23.00 | W 121 30 15.00 | 90.00 km  |     |
| KION-TV | 32 | DA   LIC    | MONTEREY      | 46. kW   | 758.0 | N 36 32 15.00 | W 121 37 14.00 | 106.54 km |     |
| KMTP-TV | 33 | ND   CP     | SAN FRANCISCO | 500. kW  | 496.0 | N 37 45 19.00 | W 122 27 16.00 | 49.43 km  | *   |
| KFSF-TV | 34 | DA   LIC    | VALLEJO       | 150. kW  | 419.0 | N 37 45 19.00 | W 122 27 16.00 | 49.43 km  | *   |
| KCRA-TV | 35 | ND   LIC    | SACRAMENTO    | 1000. kW | 462.0 | N 38 14 50.00 | W 121 30 13.00 | 105.15 km |     |
| KCNS    | 39 | DA   LIC    | SAN FRANCISCO | 1000. kW | 428.0 | N 37 45 19.00 | W 122 27 16.00 | 49.43 km  | *   |
| KKPY    | 41 | DA   LIC    | SAN JOSE      | 1000. kW | 418.0 | N 37 41 15.00 | W 122 26 11.00 | 42.89 km  | *   |
| KCSM-TV | 43 | DA   LIC    | SAN MATEO     | 536. kW  | 428.0 | N 37 45 19.00 | W 122 27 16.00 | 49.43 km  | *   |
| KBCW    | 45 | DA   LIC    | SAN FRANCISCO | 400. kW  | 446.0 | N 37 45 19.00 | W 122 27 16.00 | 49.43 km  | *   |
| KQCA    | 46 | ND   LIC    | STOCKTON      | 600. kW  | 580.0 | N 38 15 54.00 | W 121 29 24.00 | 107.33 km |     |
| KTLN-TV | 47 | DA   CP     | NOVATO        | 1000. kW | 402.0 | N 38 9 0.00   | W 122 35 31.00 | 92.59 km  | *   |
| KSPX    | 48 | DA   LIC    | SACRAMENTO    | 1000. kW | 489.0 | N 38 15 54.00 | W 121 29 24.00 | 107.33 km |     |
| KSTS    | 49 | DA   LIC    | SAN JOSE      | 257. kW  | 688.0 | N 37 29 57.00 | W 121 52 16.00 | 20.71 km  | *   |
| KTEH    | 50 | DA   LIC    | SAN JOSE      | 290. kW  | 662.0 | N 37 29 17.00 | W 121 51 59.00 | 20.61 km  | *   |
| KDTV    | 51 | DA   LIC    | SAN FRANCISCO | 476.3 kW | 701.0 | N 37 29 57.00 | W 121 52 16.00 | 20.71 km  | *   |

Can see every station not occluded by mountains, including several not receivable by DTV tuners.

# Mobile DTV Service Update

- Mobile DTV systems now being demonstrated in number of markets
- ATSC finalizing laboratory and field test plans and documents
- Open Mobile Video Coalition establishing IDOV laboratory and field test program